

REMARKS

The concurrently filed Request for Continued Examination (RCE) Transmittal is noted. The present amendments constitute the necessary Submission therefor.

The Examiner is thanked for the Interview courteously granted on May 17, 2006, in connection with the above-identified application. During this Interview, differences between the prior art applied in the Office Action mailed March 17, 2006, on the one hand, and the present invention, on the other, were discussed, and various advantages achieved by the present invention due to these differences were also discussed. In particular, the undersigned contended that the applied prior art, in particular Matlack, et al., would have neither disclosed nor would have suggested the gas-barrier multi-layer structure as in the present claims, including, inter alia, wherein the polyamide had been produced by the steps (1) and (2) as in the present claims, in particular the solid-phase polymerizing of the second step. During the Interview, the temperature of the solid-phase polymerizing as set forth in claim 12 was discussed, it being pointed out by the undersigned that Matlack, et al. would have neither taught nor would have suggested the solid-phase polymerizing, especially at the temperature in the range set forth in previously considered claim 12, or the resulting product and advantages thereof.

In addition, during the Interview, the rejection under the second paragraph of 35 USC 112 was discussed, and it was agreed by the undersigned to remove the parentheses around " t/t_0 ", and it was also agreed by the undersigned to remove the quotation marks around " t " and " t_0 ".

Applicants have amended their claims in order to further clarify the definition of various aspects of the present invention, especially in light of discussions during the aforementioned Interview. Specifically, Applicants have amended claim 10 to

remove the parentheses around "t/t0", and to delete quotation marks around "t" and "t0". Applicants have further amended claim 10 to incorporate therein the subject matter of claim 12. In view thereof, claim 12 has been cancelled without prejudice or disclaimer.

In addition, Applicants are adding new claim 13 to the application. Claim 13, dependent on claim 10, recites that the at least one thermoplastic resin layer B is at least one polypropylene layer B. Note, for example, the paragraph bridging pages 9 and 10 of Applicants' specification.

The rejection of claims 2-12 under the second paragraph of 35 USC 112, as being indefinite, set forth in Item 4 on page 2 of the Office Action mailed March 17, 2006, is noted. Applicants have deleted the parentheses around "t/t0". Moreover, as indicated previously, and from the results of discussions at the aforementioned Interview, Applicants have further amended claim 10 to delete the quotation marks around "t" and "t0". In light of present amendments to claim 10, it is respectfully submitted that the indefiniteness rejection under the second paragraph of 35 USC 112 is moot.

Applicants respectfully submit that all of the claims presented for consideration by the Examiner patentably distinguish over the teachings of the prior art applied by the Examiner in rejecting claims in the Office Action mailed October 4, 2005, that is, the teachings of the U.S. patents to Matlack, et al., No. 5,028,462, and to Harada, et al., No. 4,908,272, under the provisions of 35 USC 102 and 35 USC 103.

In particular, it is respectfully submitted that these references as applied by the Examiner would have neither taught nor would have suggested such a gas-barrier multi-layer structure as in the present claims, including wherein the gas-barrier layer A of this multi-layer structure includes a crystallizable polyamide resin,

which has a minimum half crystallization time of 40-2000s in a measuring temperature range from a glass transition point thereof to less than a melting point thereof when measured by isothermal crystallization according to depolarization photometry, and wherein such crystallizable polyamide resin is one produced by the steps (1) and (2) of (1) melt-polymerizing the diamine component with the dicarboxylic acid component to produce polyamide; and (2) solid-phase polymerizing the polyamide obtained in step (1) at a temperature in the range of 150°C to the melting point of the polyamide, with the relative viscosity of the polyamide resin thus obtained in step (2) being in a range of 2.3–4.2. See claim 10.

It is respectfully submitted that the crystallizable polyamide resin produced by the steps (1) and (2) as in claim 10 is different from, and provides unexpectedly better results than, a polyamide resin produced by melt-polymerizing only; and it is respectfully submitted, that, accordingly, the crystallizable polyamide resin as recited in the present claims, produced by the recited processing, must be considered in terms of the recited processing. See In re Luck, 177 USPQ 523, 525 (CCPA 1973).

In addition, it is respectfully submitted that the references as applied by the Examiner would have neither taught nor would have suggested such a gas-barrier multi-layer structure as in the present claims, having features as discussed previously in connection with claim 10, and additionally including (but not limited to) wherein the relative viscosity of the polyamide obtained in the melt-polymerization is in a range of 1.6 – 2.28 (see claim 11); and/or the oxygen transmission co-efficient of the polyamide resin as in claim 2; and/or melting point (see claim 3) or glass transition point (see claim 4) of the polyamide resin; and/or relative thickness of the gas-barrier layer, of the overall thickness of the multi-layer structure, as in claim 7; and/or characteristics of the thermoplastic resin for the thermoplastic resin layer B as

in claim 5, or wherein the thermoplastic resin of this thermoplastic resin layer B is a polyolefin (see claim 6) or polypropylene (see claim 13); and/or wherein the layers A and B are laminated to an intervening adhesive resin layer (see claim 8); and/or wherein the structure is made into a form of a multi-layer container (see claim 9).

The present invention is directed to a multi-layer structure having excellent gas-barrier properties, and also having fabricability, less malodor and discoloration and other excellent properties such as transparency and heat resistance.

Polyamides produced by the polycondensation of xylylenediamine and an aliphatic dicarboxylic acid such as, for example, adipic acid, have been extensively used as gas-barrier packaging materials such as films and bottles. Such polyamides have been used to form multi-layer structures composed, in addition to the polyamide, of a thermoplastic resin.

Gas-barrier multi-layer containers having a polyolefin layer and a polyamide layer have been proposed, as described on pages 2 and 3 of Applicants' Specification. However, problems arise in utilizing a higher-melting crystallizable polyamide together with a, e.g., polyolefin co-forming the multi-layer structure. That is, when a polyolefin and a higher-melting crystallizable polyamide are co-extruded into a multi-layer structure, the polyolefin resin is subject to a severe heat history; and, in particular, in the production of a multi-layer structure containing polypropylene, discoloration, malodor generation, etc., due to heat degradation of the polypropylene resin, unfavorably occur.

As can be seen in the foregoing, it is still desired to develop a multi-layer structure comprising, e.g., a layer of polyamide produced from, among other reactants, m-xylylenediamine and adipic acid, with good fabricability and capable of

providing containers that are fully satisfactory in transparency, heat resistance, appearance and gas-barrier properties.

Against this background, Applicants have found, as a result of extensive studies, that a multi-layer structure containing a polyamide resin having a specific monomer composition and a specific crystallization rate is excellent in fabricability, and has properties as desired.

In addition, Applicants have also found that in obtaining the polyamide by melt polycondensation such polyamide has a relatively low molecular weight (relatively low viscosity), e.g., has a relative viscosity of 1.6–2.28. This low viscosity in turn causes drawbacks, for example, drawdown or gradual thickening of the polyamide layer towards the edges of sheets occurring when formed into a multi-layer shaped articles such as films, sheets and bottles; and the thickness of the polyamide layer becomes uneven in the production of a bottle preform, thereby making the production of multi-layer shaped articles difficult. Applicants have further found that these drawbacks can be eliminated by further subjecting the melt-polymerization polyamide having a relatively low molecular weight to solid-phase polymerization, e.g., at a temperature of 150°C up to the melting point of the polyamide. Note, for example, the paragraph bridging pages 5 and 6 of Applicants' Specification.

As to the unexpectedly better results achieved according to the present invention, wherein the polyamide has been formed by steps including, inter alia, solid-phase polymerization, attention is respectfully directed to the Declaration Under 37 CFR 1.132 of T. Kanda, one of the named inventors of the above-identified application, submitted with the Amendment filed January 4, 2006. Attention is, in particular, directed to Polyamides 4 and 5 described on pages 3 and 4 of this Declaration, which correspond to polyamides in Example 3 in Matlack, et al. It is

respectfully submitted that these Polyamides 4 and 5 constitute the closest prior art in connection with the presently claimed subject matter. Attention is also directed to Table 6 on page 10 of this Declaration, and the discussion of the results therein as set forth on page 11. As can be seen, the polyamide resin according to the present invention contains superior effects in both formability of multi-layer sheets and formability of multi-layer containers, as compared with polyamide resins according to Matlack, et al., prepared by a polycondensation method without a solid-phase polymerization.

It is respectfully submitted that the results of this aforementioned Declaration show that the polyamide according to the present invention, prepared by processing techniques recited in the present claims, is a different polyamide than the polyamide resin of Matlack, et al., and provides unexpectedly better results as compared therewith. It is also respectfully submitted that the evidence in this Declaration supports patentability of the presently claimed subject matter.

Matlack, et al. discloses multi-layer bottles comprising inner and outer layers of a thermoplastic resin and at least one intermediate layer of a specific polyamide composition. Note column 1, lines 11-18. The polyamide composition is described most generally from column 4, line 39 to column 5, line 8. See also, column 5, lines 22-36, for a further description of the polyamide composition. Note also column 7, lines 1-6, and column 8, lines 54-59, for a further description of the polyamide composition, including techniques for production thereof. For example, this patent discloses in columns 7 and 8 that the polyamide composition can be prepared directly by condensation of acid and diamine components in suitable proportions or by blending of homopolymer and/or copolymer compositions to achieve the appropriate compositions; or by copolymerizing, e.g., isophthalic acid,

terephthalic acid, adipic acid, metaxylylenediamine and hexamethylenediamine in a preferred molar ratio. See also, for example, Example 3 in columns 12 and 13 of this patent. Melt polymerization is used in forming the polyamide.

It is respectfully submitted that this reference does not disclose, nor would have suggested, the polyamide resin as recited in the present claims, formed by the processing recited in the present claims, and advantages thereof; and/or the other features of the present invention as discussed previously, and advantages thereof.

Harada, et al. discloses a gas-barrier multi-layered structure which includes at least one layer of a specified copolyamide composed of a specific dicarboxylic acid component and specific diamine component, and at least one layer of a thermoplastic resin other than the copolyamide. Note, column 1, lines 4-11; see also column 2, lines 20-33. Note further, column 2, lines 43-45 and 49-58. Note also column 3, lines 16-18 and 31-35. See further, column 5, lines 11-14.

Even assuming, arguendo, that the teachings of Harada, et al. were properly combinable with the teachings of Matlack, et al., such combined teachings would have neither disclosed nor would have suggested the presently claimed gas-barrier multi-layer structure including the gas-barrier layer A comprising the crystallizable polyamide resin, having the recited minimum half crystallization time and formed by processing including the melt-polymerizing and solid-phase polymerizing at a temperature in the range of 150°C to the melting point of the polyamide, as recited in the present claims, and advantages thereof; and/or the other features of the present invention as in the other claims as discussed previously, and advantages thereof.

The contentions by the Examiner with respect to the teachings of Matlack, et al., as set forth in Item 6 on pages 3 and 4 of the Office Action mailed March 17, 2006, are noted. It is noted that the Examiner states that Matlack, et al. does not


specify the minimum half crystallization time, but the Examiner contends that the reference discloses the same chemical composition and thus the polyamide of the reference "would inherently have the same physical properties, such as crystallization and melting point". Such contention by the Examiner is respectfully traversed. As seen, for example, in the aforementioned Declaration, processing utilized in forming the polyamide, including degree of polymerization and type of polymerization (including temperature of the solid phase polymerization) has an effect on properties of the polyamide; and it is respectfully submitted that Matlack, et al., would have neither taught nor would have suggested the structure of the present claims comprising the gas-barrier layer A including the crystallizable polyamide resin, having the minimum half crystallization time and being a resin produced by processing as recited in the present claims.

In view of the foregoing comments and amendments, and further in view of the concurrently filed RCE Transmittal, entry of the present amendments, and reconsideration and allowance of all claims presently pending in the above-identified application, are respectfully requested.

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Respectfully submitted,

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